2.2.7.8 Electric Power

Table 2–27 shows DOE's estimate of the power demands at the Moab site and at the three potential off-site disposal locations for the three transportation modes. In general, the major demands would be:

- Field office trailers.
- Office and parking lot security lighting.
- River pump station (at Moab).
- Decontamination water sprays and recycle pumps.
- Train transfer station (rail transportation).
- Pipeline slurry system (pipeline transportation).

Table 2–27. Estimated Maximum Average Annual Electric Power Demand (kVA) For the Off-Site Disposal Alternative

Transportation Mode	Location			
	Moab Site	Klondike Flats Site	Crescent Junction Site	White Mesa Mill Site
Truck	600	300	300	300
Rail	700	600	600	–
Pipeline	–	2,500 (terminal)	2,800 (terminal)	3,100 (terminal)
To Klondike Flats	3,400			4,800 (booster)
To Crescent Junction	4,800			
To White Mesa Mill	6,100			

2.3 Ground Water at the Moab Site

Section 2.3.1 provides background on the ground water standards, contaminants of concern, and the compliance strategy selection process. This includes remediation goals for the ground water, and the relationship with existing interim actions. Section 2.3.2 discusses the proposed ground water remediation, including remediation options and time frames, and the predicted contaminant concentrations as a result of active remediation. It also discusses the predicted outcome of the ground water No Action alternative. Section 2.3.3 discusses ground water remediation uncertainties.

2.3.1 Background

The uppermost aquifer at the Moab site occurs in unconsolidated Quaternary alluvial material deposited on older bedrock units in the basin that forms Moab Valley. Although the quality of this aquifer has been adversely affected by uranium processing activities at the site, it does not represent a potential source of drinking water. However, discharge of contaminated ground water from this aquifer has resulted in elevated concentrations of ammonia and other site-related constituents in the Colorado River. While the contaminants do not pose unacceptable risk to humans, they do exceed levels considered to be protective of aquatic life. Therefore, the objective of the proposed ground water action is to protect the environment, particularly endangered species of fish that are known to use that portion of the river.

Contamination in the ground water at the Moab site is regulated by EPA standards in 40 CFR 192. Moab site remediation must comply with Subpart A standards for ground water protection and Subpart B standards for cleanup of residual ground water contamination. Subpart C provides guidance for implementing methods and procedures to reasonably ensure that standards of Subpart B are met.

DOE's proposed action for ground water cleanup was developed using the framework described in the UMTRA Ground Water Project PEIS (DOE 1996a). This framework uses a stepwise, risk-based approach for selecting a compliance strategy and is based on site-specific characteristics. The following discussion describes the PEIS framework, identifies the overall compliance strategy using this framework, and summarizes the long-term monitoring program. A more detailed description of the PEIS compliance strategy selection process is presented in the *Site Observational Work Plan for the Moab, Utah, Site* (SOWP) (DOE 2003b).

A detailed RAP would be developed following issuance of the ROD and would contain action-specific design information. However, the treatment technologies summarized in this EIS, supported by the results of site characterization studies and ground water flow and transport modeling (DOE 2003b), provide a reasonable range of scope and requirements for ground water actions to meet the requirements of 40 CFR 192. The analyses of these actions in this EIS provide sufficient information for decision-making under NEPA.

2.3.1.1 EPA Ground Water Standards

Ground water remediation actions to meet the EPA standards for inactive uranium-ore processing sites (40 CFR 192) are selected first by determining the appropriate standards for the site, then by identifying a compliance strategy that can meet the standards. Several different ground water standards could apply to the Moab site. These include background concentrations, maximum concentration limits (MCLs) (EPA ground water standards in 40 CFR 192), alternate concentration limits (ACLs), and supplemental standards (see 40 CFR 192 for definitions); applicable standards depend on site-specific cleanup objectives and conditions. Potential strategies for achieving these standards include no remediation, natural flushing with institutional controls, natural flushing with institutional controls in combination with active remediation, and active remediation alone.

At UMTRCA sites, EPA standards must be met in the uppermost aquifer, which is most likely to be affected by uranium-ore processing activities. The uppermost aquifer at the Moab site contains a highly saline (salty) water, often referred to as brine, which can be as thick as 400 ft, overlain with a thin layer of less salty water. Because ground water in the major portion of the uppermost aquifer

> ***Ground Water Compliance Strategies***
>
> ***No remediation*** means that no ground water remediation is necessary because ground water contaminant concentrations meet acceptable standards. No remediation under the PEIS is not the same as "no action" under NEPA, because actions such as site characterization would be necessary to demonstrate that no remediation is warranted.
>
> ***Natural Flushing*** means allowing the natural ground water movement and geochemical processes to decrease contaminant concentrations.
>
> ***Active Remediation*** means using active ground water remediation methods such as gradient manipulation, ground water extraction and treatment, or in situ ground water treatment, to restore ground water quality to acceptable levels.

has a TDS content exceeding 10,000 milligrams per liter (mg/L), the aquifer meets the definition of a limited-use aquifer as described in EPA's *Guidelines for Ground-Water Classification Under the EPA Ground-Water Protection Strategy* (EPA 1988).

Under the requirements of 40 CFR 192 Subpart C, the uppermost aquifer meets the criteria to apply supplemental standards based on limited-use ground water. Supplemental standards are regulatory standards that may be applied when the concentration of certain constituents (in this case, total dissolved solids [TDS]) exceeds the normally applicable standards (e.g., MCLs; see 40 CFR 192, Subpart C for further explanation) for reasons unrelated to site contamination. The use of supplemental standards must be protective of human health and the environment. Therefore, remediation of the uppermost aquifer to meet ground water or drinking water standards is not required because a limited-use aquifer is not likely to be developed as a public drinking water source. Instead, at sites with limited-use ground water, the supplemental standards require management of contamination due to tailings in a manner that ensures protection of human health and the environment from that contamination. This means that if site-related contamination could cause an adverse effect on a drinking water aquifer or on a connected surface water body, management of contamination would be necessary to protect these resources.

Because no drinking water aquifer is affected by site-related contamination, ground water remediation focuses on protecting surface water resources for beneficial use. Risk calculations show that risks to human health would be very low for all probable uses, even using conservative assumptions (see Appendix D of this EIS). However, contaminant concentrations in surface water exceed aquatic criteria for five site-related constituents. Consequently, the compliance strategy focuses on protecting ecological receptors (i.e., endangered fish) and achieving compliance goals (i.e., surface water standards) in the surface water.

2.3.1.2 Contaminants of Potential Concern

Concentrations of some site-related contaminants in ground water at the Moab site are above appropriate standards or benchmarks for protection of aquatic organisms in surface water. A thorough screening of contaminants is provided in Appendix A2. Through the screening process, five contaminants of potential concern have been identified: ammonia, copper, manganese, sulfate, and uranium. However, ammonia is the key constituent driving the proposed ground water remedial action because of its high concentrations in the tailings seepage and ground water and its toxicity to aquatic organisms (EPA 1999). It is assumed that if ammonia target goals could be achieved that are acceptable for protection of aquatic life, concentrations of the other four contaminants of potential concern would also be protective. Even though the geochemical behavior of the other contaminants of potential concern differs from that of ammonia, it is anticipated that concentrations of these constituents would decrease to protective levels in the same time frame that it would take for ammonia to reach protective levels because their concentrations are less elevated above applicable remediation criteria (e.g., surface water standards), the contaminants are less widespread, or they occur at elevated concentrations less frequently. For this reason, ammonia is the focus of the following discussion.

National ambient water quality criteria (AWQC) for the protection of aquatic life have been established for ammonia (EPA 1999). The State of Utah is in the process of adopting these criteria as state surface water quality standards. AWQC have been identified that are protective of both acute and chronic exposures. Acute criteria vary with pH; chronic criteria are both pH- and temperature-dependent. Chronic aquatic criteria represent the low end of the potential concentration range for protection of aquatic species from ammonia toxicity; the majority of chronic values fall in the range of 0.6 to 1.2 mg/L ammonia (total as N) based on site-specific pH conditions (EPA 1999). Acute criteria represent the higher end of the concentration range; the majority of acute values fall within the range of 3 to 6 mg/L. Therefore, it is DOE's position that concentrations of ammonia (total as N) in surface water in the 0.6- to 6-mg/L range would be fully protective of aquatic life.

If ground water quality met surface water standards, then discharge of ground water to the surface should not result in exceedances of those standards unless some other process (e.g., evaporation) increased contaminant concentrations in surface water. However, establishing the low end of the protective range as the ground water target goal is probably not necessary to achieve compliance with surface water standards. According to State of Utah surface water standards, chronic aquatic criteria must be met only outside a 2,500-ft-long mixing zone that starts at the point of discharge; no mixing zones are permitted for compliance with acute criteria. If acute criteria can be met, then chronic criteria should be met outside the mixing zone. In addition, available data regarding interaction of ground water and surface water indicate that concentrations of most constituents decrease significantly as ground water discharges to and mixes with surface water (a 10-fold decrease is observed on average [DOE 2003b]).

Consequently, there is a reasonable assurance that protective surface water concentrations could be achieved by meeting less conservative goals than chronic standards in ground water. The target goal of 3 mg/L in ground water (the low end of the reasonable acute range) is anticipated to provide adequate surface water protection. The 3-mg/L concentration represents a 2- to 3-order-of-magnitude decrease in the center of the ammonia plume and would be expected to result in a corresponding decrease in surface water. On the basis of sampling data presented in the SOWP (DOE 2003b), it appears that if a concentration of 3 mg/L ammonia could be achieved everywhere in surface water, approximately 99 percent of the locations sampled in the

Cleanup Terminology

Ammonia Concentrations—Where concentrations of ammonia are referred to in the text, these are expressed as *total ammonia as nitrogen (N)*. The numbers represent all forms of ammonia (e.g., NH_3, NH_4) converted to reflect only the nitrogen component in them.

Federal Ambient Water Quality Criteria (AWQC) for Ammonia—Numerical concentrations of ammonia (total as N) that are protective of aquatic life in surface water. Chronic exposure concentrations vary with both temperature and pH of the waters. Acute exposure concentrations vary only with pH of the waters. AWQC are only guidelines but can be adopted by states as enforceable standards.

Utah Surface Water Standards—State standards for protection of water quality of surface waters of the state. The standard designates appropriate uses of specific surface water bodies and provides numerical and narrative standards for those designated uses. The State of Utah is in the process of adopting federal AWQC for ammonia as the numerical standards for this constituent.

Remediation Objective—The desired condition that should result when remediation of the site is completed. For the Moab site, the remediation objective would be to meet state surface water quality standards for ammonia (both chronic and acute) in surface water where appropriate. The applicable standard for a given location is dependent on temperature and pH and the presence or absence of a mixing zone, as specified in the state standards.

Target Goal—As used in this document, the target goal for ammonia in ground water is the concentration that DOE has determined would meet the remediation objective in surface water. As explained in the text, meeting a target goal of approximately 3 mg/L ammonia (total as N) in ground water would result in compliance with Utah surface water standards for ammonia in surface water.

past would comply with the acute criteria, and given the 10-fold dilution factor, the chronic criteria would also be met outside the mixing zone. The 10-fold dilution factor is conservative, and a higher ground water concentration may also achieve compliance with surface water standards, although at a lower confidence level. Coupled with the average 10-fold dilution and the tendency for ammonia to volatilize, 3 mg/L in ground water is anticipated to result in compliance with both acute and chronic ammonia standards in the river adjacent to the site. Therefore, DOE proposes to use the 3-mg/L concentration of ammonia as a target goal for evaluating ground water cleanup options. However, the ultimate remediation objective would still be to meet all applicable ammonia standards in surface water.

2.3.1.3 Compliance Strategy Selection Process

Using the PEIS framework shown in Figure 2–40 and site-specific data collected through site characterization and analysis, DOE has evaluated compliance strategies for Moab site ground water. Table 2–28 summarizes the compliance strategy selection process for the Moab site, which is based on the current understanding of the site and cleanup objectives.

The PEIS framework, as presented in Figure 2–40, and the site-specific conditions of the Moab site presented in Chapter 3.0 indicate that a "no remediation" compliance strategy and the application of supplemental standards to ground water is appropriate for protection of human health. However it may not be protective of the environment (i.e. endangered species). Therefore, active remediation is proposed for both the on-site and off-site surface disposal alternatives until natural processes have reduced ground water contaminant concentrations to acceptable risk levels for discharge to surface water.

Section 2.3.2 discusses proposed active remediation approaches that may be implemented to meet the cleanup and long-term protection requirements, independent of surface reclamation. The final determination of the most appropriate technologies and method for ground water treatment would require a more detailed characterization and engineering analysis.

2.3.1.4 Initial and Interim Actions Related to the Proposed Action

DOE, upon accepting responsibility for the Moab site, initiated consultations with USF&WS. On the basis of these consultations, and after reviewing historical surface water quality studies and data, DOE and USF&WS agreed that an elevated concentration of site-related ground water contaminants (primarily ammonia) reaching the Colorado River posed immediate risk to endangered fish and designated critical habitat.

On April 30, 2002, USF&WS concurred with DOE's decision to implement an initial action, followed by an interim action. The goal of the initial action was to dilute ammonia concentrations at the ground water–surface water interface in areas that presented the greatest potential for fish to be present, when backwater habitat has developed. It was estimated that backwater habitat would most likely be present from June through August at flows of 5,000 to 15,000 cfs. The action focused on the segment of the Colorado River from Moab Wash extending approximately 800 ft downriver, which contributes the highest concentrations of contaminants to the river. The system was designed to withdraw freshwater upstream of the site and pump it through a distribution system to backwater areas. Because of low flows, the system was not installed in 2003. The system was installed and tested in 2004, but because of low river flows caused by a continuing drought, the targeted backwater areas never held water, and the system could not be fully implemented.

Table 2–28. Summary of Compliance Strategy Selection Process

Box (Figure 2–40)	Action or Question	Result or Decision
1	Characterize plume and hydrological conditions.	The most recent conceptual model of the site is described in the SOWP (DOE 2003b) based on characterization activities conducted by DOE in 2002 and 2003. **Move to Box 2.**
2	Is ground water contamination present in excess of 40 CFR 192 MCLs or background concentrations?	**Yes:** Maximum ground water concentrations of arsenic, cadmium, molybdenum, nitrate, radium, selenium, uranium, and gross alpha exceed the 40 CFR 192 MCLs or Safe Drinking Water Act standards at one or more monitoring points. Levels of other constituents such as ammonia and sulfate are elevated compared with background and exceed risk-based concentrations. **Move to Box 4.**
4	Does contaminated ground water qualify for supplemental standards due to a classification of limited-use ground water?	**Yes:** The uppermost aquifer is predominantly composed of brine with concentrations of TDS in excess of 10,000 mg/L, which meets one of the criteria for limited-use ground water (40 CFR 192 and EPA 1988). EPA (1988) also indicates that "the entire ground-water unit being classified does not necessarily have to meet Class III [limited-use] untreatable criteria, but a major volume would." The major volume of the uppermost aquifer meets limited-use criteria. **Move to Box 5.**
5	Are human health and environmental risks of applying supplemental standards acceptable?	<u>Human Health Risks</u>: **Yes** Ground water is not reasonably considered to be a potential drinking water source because of its limited-use designation, and this use of water does not need to be considered further. Initial human health risk assessment results indicate that there are no unacceptable human health risks associated with uses of ground water other than drinking water (e.g., irrigation) and probable uses of hydraulically connected surface water (mainly recreational use). Therefore, protection of human health does not require any cleanup of ground water. For human health, no remediation required. Apply supplemental standards. **Move to Box 7.** (Note: Remainder of compliance strategy selection is focused on environmental risks.) <u>Environmental Risks:</u> **No** Toxicity tests conducted on fish using site-influenced ground water and surface water indicate that there is a potential for adverse effects to aquatic life (USGS 2002). Federal criteria for protection of aquatic life have been exceeded for ammonia. Concentrations of other constituents in surface water are elevated above background levels (e.g., uranium, sulfate). **Move to Box 6.**
6	Does contaminated ground water qualify for ACLs based on acceptable environmental risks and other factors?	**Not applicable.** Ground water qualifies for supplemental standards. Only surface water concentrations need to be addressed. **Move to Box 8.**
8	Does contaminated ground water qualify for supplemental standards due to excessive environmental harm from remediation?	**No: Move to Box 10.**

Table 2–28. Summary of Compliance Strategy Selection Process (continued)

Box (Figure 2–40)	Action or Question	Result or Decision
10	Would natural flushing result in compliance with MCLs, background concentrations, or ACLs within 100 years?	**Not applicable.** Ground water qualifies for supplemental standards. Only surface water concentrations need to be addressed. **Move to Box 13.**
13	Would natural flushing and active ground water remediation result in compliance with MCLs, background concentrations, or ACLs within 100 years?	**Not applicable.** Ground water qualifies for supplemental standards. Only surface water concentrations need to be addressed. **Move to Box 15.**
15	Would active ground water remediation methods result in compliance with background concentrations, MCLs, or ACLs?	**Yes:** Active remediation of ground water to control discharge to surface water can achieve surface water remediation goals until natural processes have reduced ground water concentrations to acceptable levels for discharge to surface water. **Move to Box 16.**
16	Perform active ground water remediation.	This is the compliance strategy identified by the PEIS framework.

The goal of the interim action is to extract contaminated ground water near the Colorado River, thereby reducing the amount of contamination reaching the river. DOE funded, designed, and implemented the system (Phase I) in 2003, which included 10 extraction wells aligned parallel to the Colorado River. The system is designed to withdraw ground water at the rate of approximately 30 gpm and pump it to an evaporation pond on top of the existing tailings pile. On April 4, 2004, USF&WS concurred with DOE's decision to construct a land-applied sprinkler system designed to increase evaporation rates. The system was installed in the existing evaporation pond area. In July 2004, DOE installed an additional 10 extraction wells (Phase II) near the first 10 wells to increase the rate of ground water extraction and to test the effects of freshwater injection on surface water concentrations. If the interim actions are successful, a reduction in contaminant concentrations in surface water could be observed significantly sooner than the 10-year maximum time frame predicted under the proposed action.

2.3.2 Proposed Ground Water Action

This section presents the potential ground water actions for both the on-site and off-site tailings disposal alternatives and provides the basis for assessing the impacts of these actions. This section also discusses ground water remediation objectives. Section 2.3.2.1 discusses ground water remediation options. Section 2.3.2.2 discusses time frames for implementation (i.e., pre-remediation period) of active remediation. Section 2.3.2.3 discusses construction and operational requirements. Section 2.3.2.4 discusses the active remediation target goals and time frames for remediation and compares the proposed ground water action to the No Action alternative.